Chapter 2

Description of the Study Area
2. DESCRIPTION OF STUDY AREA

The coast line along north Tamil Nadu on the east coast of India lies in the northeast- south west direction from Pondicherry to Madras (Chennai) with a bulging of coast line at Palar mouth and adjoining area. This bulging is more prominent on the southern side of the Palar river mouth, which gradually tend to be straightening towards northern side of Palar mouth. Kalapakkam is situated about 68km south of Chennai on the East Coast of India. Palar River joins the Bay of Bengal on the southern part of Kalpakkam. The coast in the study area facing the Bay of Bengal in the east is mainly an alluvial plain. The alluvium consists of coarse sand along the coast and tends to be fine sand, silty sand, and clayey nature towards the Buckingham canal area (IGCAR). Generally, low-level sand dunes extend from the shore to about 1km interior. The sandy stretch of the Kalpakkam coast lies between the sea and the Buckingham canal (Fig. 1).

In an earlier study (Nair, et al., 1983) based on the pattern of rain fall and associated changes in hydrographic characteristics at Kalpakkam coast, the whole year has been divided into three seasons viz: 1)Summer (February – June), 2) South West monsoon (July – September) and 3) North East monsoon (October – January). This system has been used in the present study too for the purpose of grouping of data and for discussion of results (Fig. 2).

Wave parameters were observed visually every month at station. The wave directions were found to be between East- Southeast and Southeast in February to September. From October to January the wave directions were mostly between Northeast and East. The maximum value of wave height noted was 1m and the minimum was 0.3m. The wave height increases during the months of August to September and decreases from January to April.

The Breaker zone width varied between 15m to 80m. It was wider during July to September than the rest of the year at Kalpakkam. During the northeast monsoon (October to January) the direction was southerly. The northerly longshore currents (February to September) generally are stronger than the southerly currents (October to
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January). Wave refraction pattern for the waves approaching ranged from 8 to 12 second. In the study area, the beach has a gentle slope and the tidal range is small. The intertidal zone is only about 10m.

Madras Atomic Power Station (MAPS) is located on the south east coast of Bay of Bengal at Kalpakkam (12° 33' N & 80° 11' E), about approximately 65 Km south of Madras city (India). The MAPS consisting of two pressurized heavy water reactors, (PHWR) of 235 MWe capacity each (presently derated to 170 MWe ), Units I and II became operational on 23rd July, 1983 and 18th September, 1985 respectively. The power plant employed a 'Once through cooling system'. The intake well is located at the end of the jetty. Seawater at a rate of about 35 m³/sec is used for cooling the condensers as well as auxiliary cooling circuits such as process sea water heat exchangers. Seawater is drawn through a tunnel of 468 m length, built 53 m below the mean sea level. The tunnel is connected at the landward end to the pump house through a vertical shaft to a forebay. Similarly at the seaward end, it is connected through a vertical shaft to the intake structure. The tunnel is horse –shoe shaped in cross section, 3.8 m in diameter with a slope of 1:250 from seaward to the landward end. The intake and forebay shaft has a diameter of 4.25 and 6 m respectively. Seawater enters the intake through 16 windows, trash racks have been placed and this act as a first line of defense to prevent the entry of large animals. At the forebay, 8 condenser cooling pumps, each of 11,300 m³/h capacity and 4 process sea water cooling pumps, each of 9,600 m³/h capacity, draw sea water and circulate through the heat exchangers. Water passed through vertically moving traveling water screen (1x 1 cm mesh size) before into the circulating seawater pump. Seawater velocity inside the tunnel is about 2 to 2.5 m per sec when all the pumps are operating. The main condensers have aluminum brass (Cu 76%, Zn 22%, Al 2% & As 0.05%) tubes while process sea water heat exchanger tubes are made of Cu-Ni( Cu% 70, Ni 29%, Zn 0.4%, Fe 0.7%, Mn 0.52%). Water after circulating through the cooling system is discharged in the canal, which is on the shore through an outfall structure (north of jetty) with a built-in facility to change the direction of flow with the aid of sluice gates and lies parallel to the coast before it mixes with the open sea. The canal formation is due to the sand bar formation along the coast by the interaction of the discharged water flow and
the sea current. The length of canal varies depending on the season at times, goes up to a
distance of about 2km before mixing with the sea. The position of the mixing point
(end of the discharge canal where it mixes the sea) was found to vary between 50m to
2km from the outfall.

Biofouling has been a serious problem in the MAPS tunnel. Fouling on tunnel
surfaces has caused a drop in water level in the forebay affecting pump operation,
blockage and damage of intake screens requiring regular replacement and also blockage
of condenser tubes resulting have been found to contribute to a large amount of organic
and inorganic debris which gets deposited in the forebay causing siltation problems
inside pump hose chambers. The problems, were encountered even when intermittent
chlorination (1 to 2 ppm residual at outfall for 1 hour, once in 8 hours) was in place from
the pre-commissioning stage of the condenser cooling system.
Fig. 1. Map showing the MAPS and back water system
Fig. 2. Meteorological features of Kalpakkam